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ABSTRACT

Most discussions of measurement theory are focused on "scales" of measurement, but it is not clear whether reference is made to the mechanisms of measurement or the metric information derived from measurement. This emphasis on scales in measurement theory has not always provided a meaningful or fruitful description of measurement activities in psychology. It is proposed that a new concept, that of a standard system of measurement, be introduced to refer to the mechanism of measurement. There are three types of standard systems: (1) elementary, using human judgment; (2) devised, consisting of tests and physical instruments; and (3) dual-process, or self-report instruments. A measurement theory based on the standard system concept provides for a strengthened rationale for measurement activities in psychology. (Author/BS)

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Measurement Scales and Standard Systems in Psychology

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Running head: STANDARD SYSTEMS

Abstract

Most discussions of measurement theory are focused on "scales" of measurement. In this discussion it is not clear whether reference is made to the mechanisms of measurement or the metric information derived from measurement. This emphasis on scales in measurement theory has not always provided a meaningful or fruitful description of measurement activities in psychology. It is proposed that a new concept, that of a standard system of measurement, be introduced to refer to the mechanism of measurement. A theory based on such a concept provides for a strengthened rationale for measurement activities in psychology.

Most discussions of measurement and measurement theory have focused on the concept of a scale. Indeed, most textbooks dealing with the topic invariably quote Stevens' (1951) definition of measurement and discuss his four basic scale types.

Despite this widespread discussion of the term scale there is not a consistent meaning attached to it. The term has variously been described as:

1) the instrument or mechanism of measurement, such as a test or a physical apparatus.
2) the metric information derived from a measurement situation; for example whether order is implied or equality of units is implied.
3) a mechanism of measurement calibrated in terms of defined units.

In his 1958 book, Torgerson, for example, has indicated that a scale is the measuring device, whereas others such as Kaplan (1964) have suggested that it refers rather to the type of metric information derived in the measurement process. Still others have avoided a specific definition or have been inconsistent in the usage of the term.

A measurement theory which is founded on the concept of a scale is unfortunate for at least two reasons:

1) there is the observed lack of consistency in definition and usage of the term; and,
2) certain of these interpretations cannot be applied to certain measurational activities

in psychology. For example, the third interpretation would exclude human behavioral assessment activities.

The Concept of a Standard System

A measurement theory is proposed which emphasizes the mechanism of measurement rather than scales. The concept of a standard system is introduced to refer to all such mechanisms of measurement.

A standard system may be any mechanism which can differentiate between magnitudes, including the human capability to do so. The human can be used as a basic, or elementary standard system. The concept provides for a modified definition of measurement, which may be paraphrased as the employment of a standard system to derive metric information regarding magnitudes of properties.

In any measurement situation there are the three components illustrated in Figure 1.

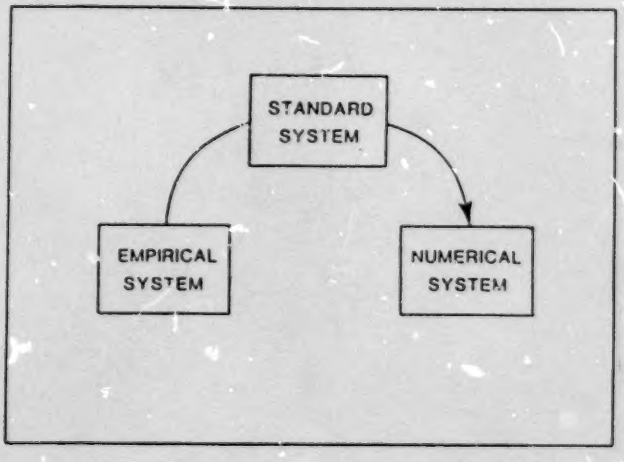

Figure 1. The major components of the measurement situation.

The empirical system refers to magnitudes of the property or attribute being measured. The standard system is the mechanism of measurement and the number system refers to the numerical descriptors used to designate magnitudes.

Types of Standard Systems in Psychology

Standard Systems are of three types: the elementary, the devised and dual-process.

The Elementary Standard System

The designation elementary standard system refers to the use of human judgment capabilities to estimate magnitude. The elementary standard system has been used in psychology to indicate magnitude of stimuli, overt behavior or latent behavioral characteristics.

Without the introduction of a concept such as the standard system as the mechanism of measurement it would be difficult to justify the use of the concept of measurement in these contexts.

Devised Standard Systems

A second type of standard system is the devised. One category includes tests, such as the ability or achievement test, and the second is physical instruments, such as the E.E.G. These standard systems are independent of the human observer and generally assess latent ability or psychophysiological characteristics of the organism.

Dual-Process Standard System

A third type of standard system has been designated dual-process and generally refers to self-report instruments of

personality or preferences and interestes. The dual processes involved refer to the assessments that the respondent must make in responding to an item and, secondly, the assessment that is being undertaken by the test.

The Measurement Process

Most definitions of measurement, including the one provided here, describe the purpose of measurement but do not stipulate the steps in the process of measurement. The measurement process describes the activity involved in obtaining an accurate measurement. The measurement process involves at least the following:

1) the identification of an appropriate standard system to denote differences in magnitude of the property in question (As was suggested the human can act as an elementary standard system.);
2) specification of an appropriate framework for deriving metric information (This process involves either establishing a unit or equality of units, or, establishing a basis for converting the information provided by the standard system to metric information.);
3) specification of procedures for evaluating the accuracy of the information provided by the standard system (These procedures have traditionally been referred to in relation

to the determination of validity and reliability. These terms have been subject to a variety of interpretations and perhaps more precise evaluations need to be specified.).

Importance of the Concept of a Standard System

A measurement theory founded on standard systems rather than scales is desirable for a number of reasons.

1) It is an integrated measurement theory that can be applied to all measurement situations in psychology and other disciplines including physics. For example, when the human is conceptualized as an elementary standard system, measurement situations involving human assessment can be integrated into the proposed measurement theory.
2) With the introduction of a concept for the mechanism of measurement the theory specifically restricts the term scale to the metric information derived in the measurement process.
3) The introduction of the concept provides for a more complete analysis of measurement situations. Previous definitions and statements of the requirements for measurement have not stipulated the agent in the derivation of numerical information.

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